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EDITORIAL.

The Trend of Agricultural Research.

Unlike the more fortunate editor of an independent publication who can command the production of articles on widely different subjects in order that each reader may find matter of personal interest, the editor of a Departmental journal must rely almost entirely on a small number of contributors who submit for publication the results of research work on which they have been engaged.

For this reason, it is frequently impossible to avoid a number of articles appearing in succession concerning the same crop, for the contributors do not "write to order", and although sometimes we are in the happy position of having articles awaiting publication, in other months we may not know the "make up" of this Journal until shortly before it is due to go to press.

The above remarks are prompted by the preparation of the Index which accompanies the present number, and which marks the completion of our twenty-third volume.

We find that during this year we have published original articles giving the results of research work by the Department on the following subjects :— coconuts, oil palms, padi, derris, nipah, cattle, poultry, fruit propagation, fruit canning, potatoes, fodder plants, and mushrooms. In addition, a number of original articles have been published dealing with such subjects as agricultural trade, the agricultural conditions in various parts of the country, and the commercial prospects of different Malayan agricultural products.

Thus, though the articles presented in any one issue of the Journal may have a limited appeal, the scope of the information given over a year is such that all aspects of Malayan agriculture receive recognition. The fact that the number of subscribers has increased considerably in 1935, and is now greater than in past years, is evidence of a wider appreciation, especially in Malaya, of the value of the information which we publish. Incidentally, in this connexion, we would add that the increase in Asiatic subscribers which has taken place during recent months is a most gratifying feature.

In glancing over the contents of this volume, we are struck by the number of articles which are concerned with investigations on the preparation for market of agricultural produce. While the field work on crop experiments

receives due notice, there has been a greater number of articles dealing with questions of economy in the factory, and the preparation of improved products.

From this fact it is evident that the Department is fully alive to the desirability of ensuring that the reputation of Malayan products on the world's markets, which has been built up in the past often under favourable trade conditions, may be maintained in the future when the level of prices may be lower and the buyer more prone to consider quality.

The future of Malayan agriculture may well depend on maintenance, or improvement, of quality together with economy in production, and we are of opinion that many of the articles in this volume constitute valuable contributions towards this end.

The two main articles in the present number are concerned with factory procedure; in one instance, the article is concerned with the improvement of the quality of canned pineapples, and in the other article the author deals with a question of factory procedure which has a bearing on cost of production.

It would appear from the evidence of this year's articles—and we might add that this contention is supported by a perusal of other scientific journals of a like nature—that the tendency both in relation to estates and small holdings is to pay increasing attention to manufacturing processes with a view to improvement of quality of the products, combined with economy in production; and that in this respect, both in Malaya and in other agricultural countries in and outside the tropics, greatly increased attention is being paid to research and investigations of this nature.

Original Articles.

THE APPLICATION OF THE EXHAUST PROCESS IN THE MALAYAN PINEAPPLE-CANNING INDUSTRY

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In recent discussions concerning the improvement of the pineapple-canning industry in Malaya, a good deal of attention has been devoted to the question of what is termed "exhausting" the cans before the final sealing operation takes place.

It should at the outset be explained that the term is usually taken to signify the heating of the can and its contents before sealing; it may also mean treatment of the container under a mechanically-produced vacuum; in either case the object sought is the removal of air from the can, so that the products are packed in a partial vacuum.

The objects which the process fulfils are as follows:—

(*a*) The removal of air from the can, thereby reducing corrosion of the tin plate, since corrosion is favoured by the presence of oxygen.

(*b*) To produce a vacuum so that the ends of the can will remain concave on standing and thus indicate to prospective purchasers that the contents of the can are in sound condition. Convex or bulged ends usually denote spoilage which has resulted in the liberation of gas in the can.

(*c*) To prevent undue strain on the can during sterilization.

(*d*) Thorough exhaustion by heat tends to prevent overfilling of the can and also permits a greater fill of soft products such as berries; at the same time the thorough exhaustion of air from the tissues of the fruit tends to improve the appearance of the product.

With the exception of the Malayan pineapple industry some form of exhaustion is universally practised wherever canning industries exist. That it has not so far been found necessary to introduce it in the Malayan industry is a somewhat remarkable circumstance; it has been suggested that the reason for this may be that Malayan pineapples are almost entirely sold in temperate climates where the air temperature is considerably lower than in Malaya, thus obviating the risk of expansion of the contained air with consequent swelling of the ends of the tins which would cause their wholesale condemnation.

In practice, in Malaya, tins are hermetically sealed before sterilization, the only exception being in the case of large tins of pineapple pulp which are vented before sterilization and afterwards closed, for the reason that such tins will not stand the increase in pressure which occurs when they are sterilized without such provision.

There seems, however, little reason to doubt that the introduction of an exhaust process into the Malayan canning industry would result in an improvement of the quality of the pack and in a reduction in the number of spoils.

It may be added that under the national mark system in the United Kingdom an exhaust system is compulsory in canning fruits and vegetables.

The oldest method of exhausting tins consisted in heating them in the cooker, puncturing them to allow air to escape (blowing) and resealing again with solder (tipping). This method has now been abandoned for fruit in practically all countries and is actually prohibited in many, while it is rapidly being superseded in the case of vegetables, meat and fish.

At the present time exhaustion is usually brought about by exposing the tins, which have been filled with fruit and syrup but on which the lids have not been fitted, to a temperature of 170°F. to 205°F. for a period which varies somewhat according to size of the tin, the nature of the contents and the actual temperature and which may range from 6 to 15 minutes. In general, a longer exhaust at a lower temperature, say 170°F., is preferred to a shorter exhaust at a high temperature.

Immediately on completion of exhaustion the lid of the can is sealed in place and the process of sterilization is completed by cooking the sealed can in boiling water.

After sterilization and cooking, a 2½ lb. can of fruit should show a vacuum of 8 to 15 inches when tested with a can vacuum testing gauge, the vacuum varying according to the temperature at the time of sealing.

Various types of exhausters are used but the principle involved is the same in every case; consisting in making the filled cans travel slowly through a long metal box to which live steam is admitted. The four main types are :—

(*a*) The disc exhaust box, consisting of a metal box in which are several rows of metal discs from 15 to 18 inches in diameter fitted with cog gears which mesh together; above the discs are curved iron rods which guide the cans through the exhaust box. The number of rows of discs and the height of the exhaust box vary with the capacity and with the nature of the product to be exhausted. The cans travel down one row of discs and up the next and finally are delivered to the can-closing machine.

(*b*) The cable exhaust box, consisting of a shallow rectangular metal container through which passes a steel cable which carries the cans.

(*c*) The chain exhaust box, which is a modification of the cable box in which the cable is replaced by a chain conveyor.

(*d*) The circular exhaust box, in which cans follow a spiral or circular path in passing through the box; its use is indicated when floor space is limited.

It may be added that a rotary exhaust box, in which the cans are carried through a steam-filled cylinder on a reel, has recently been developed.

When food products are packed in glass they are usually exhausted under a mechanically produced vacuum instead of by heat and this process has to some extent been applied to certain classes of canned goods.

Preliminary Trials of the Exhaust Process on Malayan Canned Pineapples.

In order to obtain some information on the effect of exhaustion when applied to Malayan pineapples some preliminary trials were recently carried out by the Agricultural Officer, Singapore, through the courtesy of the Officer-in-Charge of Fisheries Department, who placed his laboratory and equipment at the disposal of the Department of Agriculture.

In these trials it was possible to test the effect of (*a*) cold exhaust and (*b*) hot exhaust on the appearance and quality of samples of Malayan pineapples obtained from a Singapore factory. The tests and results were as follows :—

Test 1.

Samples of freshly-cut cubes and slices, obtained from a local cannery, were placed in 5 lb. "Ball" fruit-preserving jars, and a 17 per cent. (Balling) cold solution was added.

The samples were as follows :—

Jar 1 "Golden Cubes"
Jar 2 G.A.Q. Cubes
Jar 3 Golden R.C. Slices
Jar 4 G.A.Q. R.C. Slices.

An exactly similar set of four jars containing pineapples of the same grade was then prepared, and was used as a control in the test.

The first set of jars, with the lids loosely fitted, was placed in a totally enclosed and air-tight empty container to which was connected a tube leading to a small exhaust pump, driven by an electric motor. The exhaust chamber was fitted with a small pressure gauge which registered the degree of vacuum inside it. The motor was started and the exhaust process commenced. A partial vacuum (*i.e.* reduced pressure) of 22 inches was registered after 5 minutes, and this pressure was maintained for a further 15 minutes, so that exhaustion of the air was carried out for a period of 20 minutes. The chamber was then opened and the jars were placed in boiling water and subjected to cooking for 40 minutes.

The control jars were tightly sealed and were placed in boiling water and subjected to cooking for 40 minutes.

When both sets of jars had been treated, they were allowed to cool and the contents were examined. Considerable differences between the exhausted and non-exhausted samples were apparent. These differences may be listed as follows:

	Exhausted.	Non-Exhausted.
Jar 1. Golden Cubes.	Colour rich golden and even throughout. Cubes had a translucent and very attractive appearance. Flavour good and texture smooth.	Colour golden, but uneven throughout. Texture rather fibrous and cubes not translucent. Flavour good.
Jar 2. G.A.Q. Cubes.	Colour even yellow — almost golden. Translucent appearance. Texture smooth and non-fibrous. Flavour very good.	Colour light yellow and not even throughout. Texture rather fibrous and coarser than exhausted cubes. Flavour good.
Jar 3. Golden Slices.	Colour rich golden and very even. Translucent appearance. Flavour very good. Texture smooth and non-fibrous.	Colour golden but not even throughout. Flavour good but texture somewhat coarser than exhausted slices. Appearance not so attractive.
Jar 4. G.A.Q. Slices.	Colour even yellow — almost golden. Texture smooth and appearance translucent, and less fibrous. Flavour very good.	Colour yellow but not even. Texture rather coarse and somewhat fibrous. Appearance less attractive than exhausted slices. Flavour good.

From the above tests it will be seen that the cold exhaust process produced a definite enhancement in colour, a more attractive translucent appearance, a smoother texture, and an improvement in flavour. The enhancement of colour was so striking in some cases that it seemed quite possible that fruit which normally would be classed as G.A.Q. would be suitable for inclusion in the "Golden" Grade.

Test 2.

A similar experiment was performed, with the same grades and using the same type of controls, with the hot exhaust method. This is the method that would normally be employed in a modernized cannery. In this case the exhausted jars were kept in water at 112°F. for 30 minutes. The jars were then cooked for 40 minutes. It should be remembered that the jars were large, and the exhaust process and the period of cooking must, therefore, be considerably longer than would be necessary for a normal 1½ lb. or 2 lb. tin.

The control jars were simply cooked with the lids tightly sealed, for 40 minutes, in boiling water.

Results.

The same differences in appearance, colour, flavour and texture were noticeable as in Test 1, but to a slightly less marked extent. The enhancement of colour was, however, again definite, as was also the improved appearance.

Conclusions.

As a result of these preliminary tests, it is possible to state that the exhaust process produces in preserved pineapples certain distinct improvements in colour, general appearance and flavour, compared with fruit produced by the method now employed in Malayan canneries. These tests should be regarded in the nature of preliminary tests only, and more detailed work on the optimum time of exhaust for pineapple in tins, instead of jars, is necessary before making final recommendations. Perhaps the most important feature emerging from the tests is that of the deepening and improving of the colour, since it seems quite possible that the proportion of Golden Quality to G.A.Q. quality fruit can be considerably increased by employing an exhaust process.

In the preparation of these notes the following works have been consulted :—

"Commercial Fruit and Vegetable Products" by W. V. Cruess, 1924. The McGraw-Hill Book Co. Inc., New York.

"Principles of Fruit Preservation" by T. N. Morris, 1933. London, Chapman and Hall.

Bulletins of the Canning Research Station, Campden, Gloucester.

BOILER-FEED WATER TREATMENT IN THE PALM OIL FACTORY

BY

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Introductory.

The following article gives an account of a recent survey made of boiler-feed waters from the majority of oil palm estates in Malaya with the object of recommending treatment, where necessary, to ensure boilers being maintained in a satisfactory condition.

Although the main object of the palm oil factory manager is the maximum recovery of high-quality palm oil and palm kernels, the provision of a satisfactory feed water supply and the maintenance of the boiler in a clean condition are essential to the efficient working of the factory. Apart from heavy expenditure on account of repairs and renewals to the boiler resulting from the use of an unsatisfactory feed water supply the dismantling of the boiler results in a suspension of factory operations, which will be reflected in a deterioation in quality of the estate palm oil.

General Considerations on Feed Waters for Boilers.

Boilers are designed to remove the heat from the heating suface as fast as the furnace supplies that heat, water being the agency for the removal of heat.

If the heating surface is not kept clean, this transference will be adversely affected; heat will be wasted and may actually cause harm to the boiler. In addition, fuel will be wasted instead of being economized.

The maintenance of the heating surface in a satisfactory condition is dependent both on the quality of the water supplied and on the behaviour of the water under the working conditions of the boiler.

The three essential qualities of a good boiler-feed water may be summarized as follows:—

(*a*) Absence of any corrosive effect on boiler.

(*b*) Absence of scale-forming constituents.

(*c*) Freedom of water from matter in suspension.

Each of these qualities will be referred to separately.

(*a*) *Corrosion of Boiler.*—Iron is attacked by free acids; either strong acids, for example, sulphuric acid, or weak organic acids, such as humic acid; by vegetable oils which may decompose at the temperature of the boiler, yielding free fatty acids as one of the products of decomposition; and by various salts, especially at high concentrations.

An acid water can be rendered innocuous, as far as corrosion is concerned, by treatment with a suitable alkali, for example, slaked lime (calcium

hydroxide) or soda ash (sodium carbonate). Details of suitable alkali treatment will be given later.

Care should be taken to ensure that the feed water tank is always maintained free from oil, either vegetable or mineral. Apart from the question of general corrosion by vegetable oils referred to above, the presence of an oily deposit on the heating surface of a boiler may easily result in local corrosion owing to the deposit being practically non-conducting and the iron being subjected to an unnecessarily high temperature. The latter may be sufficiently high to cause local "burning" of the metal.

The solids in solution in a good quality boiler water should not exceed 10 parts per 100,000.

Excessive accumulation of salts in solution can be avoided by frequent cleansings of the boiler, that is emptying the boiler and refilling with fresh water. Further reference will be made to this question.

Oxygen in the feed water will cause rusting of the boiler, the rusting action becoming more serious if the water contains appreciable amounts of salts in solution, for example, common salt (sodium chloride). While the presence in the water of a slight excess of alkali, for example, soda ash (sodium carbonate), tends to inhibit this rusting tendency, the virtual exclusion of air from the feed water is the most satisfactory course to adopt. This can be accomplished by maintaining the feed water as hot as possible (the feed water tank being heated by exhaust steam) and by ensuring that the level of the water in the feed tank is never allowed to sink to a level sufficiently low to cause the pump to suck air.

(*b*) *Boiler Scale.*—Boiler scale is correlated with the hardness of the water, which is measured by its power to precipitate soap.

Hardness is caused by the presence in the water of the soluble salts of most metals other than the alkali metals, sodium and potassium. In the majority of cases, hardness is due mainly to the salts of calcium and magnesium, and, to a lesser degree, to salts of iron and aluminium.

In this connexion, it may be mentioned that, while acid waters also possess this soap-precipitating property, they are not usually referred to as hard waters, but are classified separately. This distinction is maintained in the present article.

Two types of hardness are recognized; temporary, and permanent.

Temporary hardness is so called because it can be removed by boiling the water. This type of hardness is due to the presence in the water of bicarbonates of certain metals, usually calcium and magnesium—occasionally iron—which are soluble. As a result of boiling, the bicarbonate is decomposed, carbon dioxide is expelled, and the less soluble normal carbonate is precipitated. An example of this is to be found in the cloudy appearance which water in a limestone district develops on boiling, the cloudiness being due to minute particles of calcium carbonate in suspension produced as a result of the decomposition of calcium bicarbonate present in the original water.

Permanent hardness is that which persists after boiling. It is due to the combined effect of small quantities of residual normal carbonates (magnesium carbonate, for example, being appreciably soluble in water) and of other salts, principally sulphates, nitrates and chlorides, of calcium and magnesium.

As regards the determination of hardness, the method usually employed consists in ascertaining empirically the amount of soap which has to be precipitated by a given volume of the water before a lather can be obtained and expressing this in terms of the equivalent amount of calcium carbonate which must be dissolved in the same volume of water to precipitate the same amount of soap. An English degree of hardness is equivalent to 1 grain of calcium carbonate per one Imperial gallon of 70,000 grains, or 1.43 parts of calcium carbonate per 100,000 parts of water.

When hard water is evaporated there is a gradual concentration of these salts until eventually the volume of water in the boiler is unable to dissolve them, the solid matter settling on the shell, tubes or furnace crown of the boiler as a scale, which varies in hardness according to the nature of the salts.

In addition to the concentration of the salts *per se*, the possibility of chemical changes taking place between them under the condition of the increased concentration must not be overlooked.

The net result is the same in both cases, namely, the deposition of a non-conducting layer of mineral matter within the boiler. This results in a checking of the transmission of heat to the water, while increased supplies of fuel are required, the latter resulting in the boiler plates being subjcted to an unnecessarily excessive degree of heat which may cause damage to the plates.

Hardness can only be removed by treatment of the water with required amounts of suitable chemicals. For example, temporary hardness can be destroyed by the addition of slaked lime (calcium hydroxide), permanent hardness by soda ash (sodium carbonate), the combined treatment using these two chemicals being known as the lime-soda process.

It cannot be emphasized too strongly, however, that the amounts of reagents added must be based upon experimental data. For example, the indiscriminate use of slaked lime to neutralize temporary hardness would result in an increase in the hardness of the water.

Another process for the removal of hardness from water, which is used on a large scale in Europe, is the "Permutit" process. This consists in allowing the water to percolate through material, which is known under the above name and which consists of a complex silicate with sodium as the replaceable metallic base. When water containing calcium in solution is brought in contact with this material there is a base exchange, the "sodium permutit" being transformed into "calcium permutit". In other words, the calcium salts in the water are replaced by sodium salts, which have a much higher solubility and do not tend to form scale.

Another interesting feature of the process is that the "sodium permutit" can be revivified by treatment of the "calcium permutit" with a solution of common salt (sodium chloride). A reverse base exchange takes place, the sodium chloride and the "calcium permutit" forming "sodium permutit" and calcium chloride. The latter salt is very soluble and is washed away.

(*c*) *Matter in Suspension.*—The third criterion of a good boiler-feed water is freedom of the water from solid matter in suspension. This needs no emphasis, since it will be realized only too clearly that all solid matter in suspension in the water must be deposited eventually within the boiler. Such a deposit, while possibly not so hard as a boiler scale proper, will also be practically non-conducting; the effect on the boiler will, therefore, be similar to that described previously.

If, therefore, the raw water contains solid matter in suspension, the first essential is the provision of a settling tank or sump in which adequate sedimentation, assisted by chemical precipitation if necessary, can be effected, only the clear supernatant water being ultimately passed to the feed water tank.

In this connexion attention is also drawn to the advisability of protecting from all kinds of external pollution the feed water supply for the factory. For example, in the case of surface water the supply should not be derived from the same side of the factory as that on which the effluent is run to waste, unless the latter is discharged at a lower level than the water is drawn. Similarly, in the case of a jungle stream and sump, the latter should be protected by barbed wire to prevent access by labourers.

Boiler-Feed Water Supplies on Oil Palm Estates.

The source of the feed water supply varies. On some estates wells have been sunk, on others small jungle streams have been diverted into deep sumps, while in a few cases drain water, either alone or diluted with rain water (the latter being collected from the factory roof), is used. In the case of estates in the last category attention is drawn to the wide variations in the quality of the water.

Apart from the question of solid matter in suspension to which reference has already been made, the results of analysis have indicated that of the two other factors, namely acidity and formation of boiler scale, the former is by far the more important.

The tendency to scale formation is practically non-existent. This is confirmed by the figures in Table I which gives the results of analyses of feed waters from different estates for solid matter in solution, also calcium and magnesium contents, figures for water from Kuala Lumpur supply being added for purposes of comparison.

Table I.

Results of Analysis of Boiler-Feed Waters from Oil Palm Estates.

Sample No.	Source of Supply	Solids in Solution. (dried at 100°C)	Calcium (calculated as CaO).	Magnesium (calculated as MgO)
		parts per 100,000	parts per 100,000	parts per 100,000
1	Well ...	4.5	0.29	0.26
2	Stream ...	7.0	0.25	0.20
3	Stream and Sump ...	11.4	0.22	0.16
4	Drain ...	7.3	0.40	0.21
5	Kuala Lumpur Town supply ..	6.0	0.32	0.17

The above figures show that the total solids in solution are low. The calcium and magnesium, which may be regarded as the scale-forming constituents, are also low; in no case does the combined figure for these two metals reach 1 part per 100,000.

Additional confirmation of the absence of any tendency to hardness in Malayan water supplies is supplied by Blair (1). The results of analysis of raw waters for towns' drinking supplies in Malaya for the year 1932 show in no case a total hardness figure greater than 2 parts per 100,000—a marked difference when compared with the total hardness figure for London water which approximates to 25 parts per 100,000, of which about 6 parts are due to permanent hardness, the remainder being temporary.

Although some so-called boiler scales have been submitted for examination, the results of analysis indicate that they do not consist primarily of a deposit from the solid matter originally in solution in the water, but of solid matter in suspension which has become consolidated as a hard deposit partly owing to a cumulative effect and partly owing to interaction with some of the salts in the water.

Attention is, therefore, drawn once again to the necessity of ensuring that feed water is free from suspended solids; also to the importance of emptying the boiler at regular intervals and refilling with fresh water, thereby preventing undue accumulation of solid matter in solution.

During the course of the survey the writer found that this question of a rapid increase in the concentration of solid matter in solution was apt to be overlooked, an occasional "blow-down" of the boiler being considered adequate. The following example, which is based on actual practice, illustrates this point.

The boiler-feed water is free from matter in suspension and contains 10 parts of solids in solution per 100,000. The boiler has a working capacity of 300 gallons and approximately 1,000 gallons of water are evaporated daily. Calculation shows that after 25 working days (1 month) the amount of solid matter inside the boiler will be approximately 25 lbs. Presumably this will still be in solution, since there are 3,000 lbs. of water in the boiler, but after another two months the quantity will have increased to approximately 75 lbs. and the liquid in the boiler will then consist not of water but of a 2.5 per cent. solution of mineral salts. This concentration may be sufficiently high to cause corrosion of the boiler.

The example serves to emphasize the importance of frequent cleansings of a boiler at regular intervals, say once a month. The water should be allowed to drain away and the boiler refilled with fresh water. It is unnecessary to open up the boiler to effect this. Further, this operation should be carried out preferably at the end of a working day before any appreciable proportion of the solid matter in suspension has settled, in order to ensure the maximum cleansing effect.

General Considerations on Treatment of Acid Feed Waters.

All the samples of boiler-feed water examined during the course of the recent survey were found to be acid in reaction. The pH values ranged from 3.0 to 6.8, pH 7.0 being neutral.

In the case of those samples having a pH value of 3.0, experiments showed the presence of sulphuric acid in the water. These samples were taken from estates situated both in the coastal peat and coastal alluvial areas. Dennett has already drawn attention to the presence of sulphuric acid in the soil water from such districts (2).

Further, in the case of estates on coastal peat areas experiments showed the presence in the water of varying amounts of weak organic acids which may be designated as humic acid.

In four instances, the feed water showed a change in reaction on boiling. Thus, in the case of one estate the feed water was very slightly acid in reaction, the pH values being approximately 6.6, yet a sample of water drawn from the boiler was markedly alkaline in reaction, having a pH value of approximately 9.0. This change in reaction on boiling was confirmed as a result of boiling a sample of the water in a platinum basin.

This change in reaction can only be attributed to the presence in the feed water of soluble bicarbonates, for example, potassium and sodium bicarbonates, which, owing to the presence of excess carbonic acid, would react very slightly acid. On boiling, these bicarbonates would be decomposed, carbon dioxide being expelled leaving the normal carbonates in solution, which are alkaline in reaction.

Provided this change in reaction on boiling is a constant feature, waters of this type need no special treatment. Care should, however, be taken to

test the water from the boiler at regular intervals (using the appropriate indicator, phenolphthalein) in order to maintain the correct alkalinity. This point will be referred to later.

As stated previously, an acid water can be rendered harmless, as far as corrosion of the iron shell of the boiler is concerned, by treatment with a suitable alkali. Further, similarly to the treatment of water for the removal of hardness, the alkali must be added in the correct proportion. This can only be ascertained as a result of controlled experiments with the feed water.

In this connexion attention is drawn to the necessity of protecting from corrosion the feed water system including piping, pump and tanks, and, therefore, to the importance of adding the requisite amount of alkali to the water as soon as possible after the water enters the feed water system from the natural source of supply.

Various alkalis may be used for neutralization of acidity. Among these may be mentioned slaked lime (calcium hydroxide), caustic soda (sodium hydroxide) and soda ash (sodium carbonate).

In large-scale plants slaked lime is employed. This alkali has the disadvantage that if used alone with a water containing sulphuric acid the latter will be replaced by an equivalent amount of calcium sulphate, which is a scale-forming constitutent. The effect of the calcium sulphate must be counteracted by the addition of soda ash, which reacts with the calcium sulphate yielding calcium carbonate and sodium sulphate. The calcium carbonate is insoluble and can be removed by sedimentation, leaving the comparatively innocuous sodium sulphate in solution. This double treatment, to which reference has already been made, is considered too complicated for the relatively small amounts of water that must be treated daily in a palm oil factory.

Caustic soda is a satisfactory alkali from the chemical point of view; it has the disadvantage of being inconvenient to handle, owing to its action on the skin. This disadvantage does not apply to soda ash, which is a dry powder and easy to dissolve in water.

The treatment of the water resolves itself, therefore, into a determination of the acidity of the feed water and the addition of the calculated amount of soda ash to neutralize that acidity.

As will be seen later, the acidity determination is carried out by titrating a measured volume of the water with decinormal caustic soda solution, using phenolphthalein as indicator, and then calculating the equivalent amount of soda ash which must be added to a definite volume of feed water.

Attention is drawn to two points in connexion with this treatment: (*a*) variations in the acidity of the water and (*b*) an increase in the alkalinity of the boiler water. The latter is only found in the case of water from peaty areas, and is due to the decomposition within the boiler of a proportion of the sodium humate, which is formed as a result of treatment with soda ash. Sodium carbonate is one of the products of decomposition of sodium humate.

Both of these factors are beyond the range of human control, the acidity of the water varying with the weather conditions, and the amount of decomposition varying with the proportion of humic acid present in the water and the boiler pressure developed.

The alkalinity of the boiler water is of considerable importance. Although boiler practice shows that the most satisfactory results, as far as the general upkeep of a boiler is concerned, are obtained by ensuring a water which is slightly alkaline in reaction, it has also been shown that an excess of alkali must be avoided. An excess of alkali in the water tends to result in embrittlement of plates. It is recommended, therefore, that the alkalinity of a boiler water should not exceed 10 parts of sodium carbonate per 100,000.

In the case of every estate, therefore, in which the feed water is definitely acid, remains so on boiling and is treated with soda ash, it is recommended that the testing of the feed water for acidity and of the boiler water for alkalinity should form part of the daily factory routine.

The testing of the feed water for acidity has already been mentioned. The testing of the boiler water for alkalinity is carried out by titrating a measured volume of the water with decinormal hydrochloric acid, using methyl orange as indicator.

Since all oil palm estates are familiar with the method of determining the acidity of palm oil, the carrying out of two simple titrations, using standard alkali and acid respectively, should present no difficulties.

A method based on the above procedure will now be described, and, it may be mentioned, is already in use on two estates and has been found to work satisfactorily.

Method of Treatment for Acid Feed Waters.

As a preliminary the working volumes of the following must be determined: (*a*) supply tank for factory water system or alternatively small feed tank for boiler, (*b*) boiler.

An average sample of the feed water is drawn, preferably while either tank is being filled.

One hundred c.c. of the water are measured by means of a measuring cylinder and poured into a white basin, or into a white deep soup-plate. A few drops of phenolphthalein indicator solution are added and the liquid titrated with decinormal caustic soda solution until a pale pink coloration persists. The liquid must be stirred constantly during the operation with a glass rod to ensure thorough mixing of the alkali solution and the water. The number of c.c. of standard alkali solution used is noted.

If the water is so discoloured that the change to pink cannot be seen, a slightly different procedure is adopted. No phenolphthalein indicator solution is added to the water, but drops of this indicator are placed on a glazed tile provided with small depressions, one drop of indicator in each depression. The standard alkali solution is added to the water in the usual way, the

progress of the titration being marked by withdrawing one drop of the liquid from the basin by means of a glass rod and transferring the drop to one of the depressions. The end-point of the titration is reached when as a result of mixing liquid and indicator a pink coloration develops.

The number of c.c. of standard alkali solution being known the amount of soda ash in ounces required to neutralize 1,000 gallons of water is obtained by multiplying this figure by 8.5.

The requisite amount of soda ash is weighed, dissolved in hot water at the rate of approximately 2 ozs. per pint and the alkali solution added to the water.

The method of addition of the soda ash solution to the feed water varies according to circumstances. For example, in the case of those estates on which a large sump or tank capable of supplying the requirements of the factory for one day or more is available, the total amount of alkali can be added while filling; on other estates, on which a small feed water tank (say 100 gallons capacity) alongside the boiler is used as the unit of supply the amount of alkali solution for each charge must be added as the tank is filled.

Further, in the case of estate factories in which only a very small feed water tank is available and the water is passing along more or less continuously, the most satisfactory arrangement to adopt is to allow the alkali solution to drip continuously into the feed water supply. The volume of the alkali solution and the rate of drip must be adjusted so that by the end of the day the requisite amount of alkali, based on the working consumption of the boiler, has been added.

The important feature of this part of the treatment is neutralization of the acids present in the feed water without development of excessive alkalinity in the boiler water.

At the end of the working day, a sample of the boiler water is drawn and allowed to stand until the following morning. After filtration, if necessary, 100 c.c. of the water are measured into a porcelain basin or soup-plate, a few drops of methyl orange indicator added, and the liquid titrated with decinormal hydrochloric acid until a pink coloration persists in the liquid. The liquid must be stirred constantly during the operation.

If the colour of the boiler water is too dark to permit of a satisfactory end-point the method of testing the liquid by drops on a porcelain tile, referred to previously, must be adopted.

The volume of decinormal hydrochloric acid required for neutralization should not exceed 2 c.c. per 100 c.c. of water. This corresponds to an alkalinity of approximately 10 parts per 100,000, calculated as sodium carbonate.

The amount of alkali corresponding to any excess of acid over 2 c.c. must be calculated as soda ash and the necessary allowance made when calculating the requisite amount of alkali for use with the feed water.

An excess of 1 c.c. of acid per 100 c.c. of boiler water corresponds to an excess of 2.4 ozs. of soda ash per 100 gallons of water. Thus, assume that

the working capacity of the boiler is 500 gallons and 4 c.c. of decinormal acid—that is an excess of 2 c.c.—are required to neutralize 100 c.c. of the water, the excess soda ash in the boiler is 5 x 2.4 x 2.0 = 24 ozs.

An example will, however, explain more clearly this method of correlating the alkalinity of the water in the boiler with the acidity of the feed water.

The following details are assumed :—

(*a*) Working capacity of boiler 300 gallons.

(*b*) Daily consumption of water 1,000 gallons.
(This is based on the feed water tank beside the boiler, which holds 50 gallons, being filled 20 times.)

(*c*) On the previous day the consumption of water was only 900 gallons and there are 2 pints of soda ash solution (10 ozs. in 1 gallon) available.

(*d*) 3 c.c. of decinormal hydrochloric acid are required to neutralize 100 c.c. of boiler water, using methyl orange as indicator.

(*e*) 100 c.c. of the feed water require 2.5 c.c. of decinormal caustic soda to neutralize the acidity, using phenolphthalein as indicator.

There is 1 c.c. of decinormal hydrochloric acid in excess per 100 c.c. of water, which corresponds to an excess of 3 x 2.4 x 1.0 = 7.2 ozs. of soda ash in the boiler at its working capacity.

Further, the 2 pints of soda ash solution contain 2.5 ozs.

The total excess of soda ash is 7.2 + 2.5 = 9.7 ozs.

One hundred c.c. of feed water require 2.5 c.c. of decinormal caustic soda, equivalent to 2.5 x 8.5 = 21.25 ozs. of soda ash per 1,000 gallons.

The requisite amount of soda ash to be weighed out is 21.25 — 9.7 = 11.55 ozs. (say 11.5 ozs.). This amount is dissolved in hot water, the 2 pints of solution from the previous day added and the total volume adjusted to 2½ gallons. One pint of this solution is added to the feed water tank on each occasion of filling.

In order to facilitate reference the pro forma given in Table II has been compiled. Such a pro forma will be found useful for keeping daily records of the variations in the quality of the water.

The Use of Boiler Compounds.

During the course of the survey, the writer found that on several estates boiler compounds, that is proprietary preparations, were being added to the water in the boiler for protective purposes.

In the case of one alkali preparation which was analysed, the market value was estimated to be approximately one-tenth of the price charged.

In another instance it was considered that the preparation served no useful purpose and might prove harmful if used for any length of time.

The results of the present investigation have shown that the tendency to scale-formation is practically non-existent. The addition of compounds to prevent and/or remove scale is therefore unnecessary.

Table II.

Correlation of Acidity of Feed Water with Alkalinity of Boiler Water.

(Capacity of Boiler—300 gallons).

(1) Date	(2) No. of cc. of N/10 Acid per 100 cc. of Boiler Water.	(3) Excess of Acid over 2.0 cc.	(4) Excess of Soda Ash in Boiler*	(5) Excess of Soda Ash in Solution.	(6) Total Excess of Ash Soda (4) + (5)	(7) No. of cc of N/10 Alkali per 100 cc. of Feed Water.	(8) Corresponding amount of Soda Ash per 1,000 gallons. †	(9) Balance of Soda Ash required.
	c.c.	c.c.	ozs.	ozs.	ozs.	c.c.	ozs.	ozs.
1.11.35	30.0—27.0=3.0	1.0	3 x 2.4 x 1.0 =7.2	2 x 1.25=2.5	7.2+2.5=9.7	12.5—10.0=2.5	2.5 x 8.5=21.25	21.25—9.7=11.55 say 11.5

* To be calculated at the rate of 2.4 ozs. per 100 gallons for every c.c. or part of a c.c. above 2.0 c.c.

† To be calculated by multiplying the figure in column 7 by 8.5.

As regards proprietary alkali preparations, estate managers would be well-advised, at least on the grounds of economy, to avoid such preparations and to rely upon the use of an alkali of known composition, such as soda ash, applying it in the manner described.

In this connexion, attention is drawn once again to the advisability of adding the soda ash in controlled amount to the feed water rather than relying upon its fortuitous addition to the boiler in the hope that at any time the alkalinity of the water will be within the limit.

Remarks and Conclusions.

The writer is well aware that the method outlined in this paper has been criticized on the grounds that it is somewhat complicated and too difficult for the average Asiatic subordinate on an oil palm estate.

The establishment of palm oil factories in Malaya has marked the introduction of controlled factory methods, and it is considered that such methods should be extended to include the feed water supply to the boiler.

The controlled treatment of feed water is the only certain method of reducing corrosion in a boiler to a minimum and, as stated previously, an Asiatic subordinate who can determine accurately the acidity of a sample of palm oil should not find it difficult to carry out two simple alkali-acid titrations, which involve merely colour-changes for their end-points. Further, the fact that the method is working satisfactorily on at least two estates is an additional proof that the method is applicable to other oil palm estates.

As far as yields of products are concerned, the boiler does not give a direct return but, if the quality of the feed water is controlled and the alkalinity of the boiler water maintained within the limit specified, the management can rest assured that the boiler will then be taking its full share as regards ensuring the maximum efficiency of process under the most economical conditions.

In conclusion, the writer wishes to acknowledge the assistance rendered by Mr. P. A. Bray, Superintendent, Bungsar Power Station, and Mr. Gunn Lay Teik, Assistant Analyst. Mr. Bray supplied certain information concerning boiler practice in general, while Mr. Gunn Lay Teik was responsible for the greater part of the analytical work involved.

References.

(1) Blair, R. W. The Water Supplies of the Federated Malay States. Institute of Medical Research, Federated Malay States, Bulletin No. 2, 1933.

(2) Dennett, J. H. The Classification and Properties of Malayan Soils. *Malayan Agricultural Journal,* Vol. XXI, No. 8, August, 1933, page 347.

NOTE ON THE USE OF BARIUM CARBONATE AS A RAT POISON ON OIL PALM ESTATES

BY

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and

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Introductory.

Barium carbonate, mixed with bran or fish meal, is used for the destruction of rats on oil palm estates, the poison bait being placed in the run or burrow along which the animal passes.

Recently on some estates, rats, in addition to feeding on the fruits, have commenced attacking the freshly-opened female inflorescences. This method of attack involves a much greater loss of oil, since the fruit never forms. In the case of fruits it is seldom that the whole of the pericarp is consumed owing to the protection afforded by the bunch to the lower portion of each individual fruit.

In those cases in which the inflorescences are being attacked a suggestion has been made to sprinkle them with barium carbonate.

The application of barium carbonate at this stage necessitates attention being given to (*a*) the effect on pollination and (*b*) the possibility of the introduction of barium compounds in toxic quantity into the oil. The latter point is of importance in view of the possible application of the palm oil for edible purposes.

An experiment was therefore carried out at the Central Experiment Station, Serdang, to obtain information on these points.

Effect on Pollination.

Eight receptive female inflorescences on four-year old palms and a similar number on ten-year old palms were selected for the experiment.

Four inflorescences in each set of bunches were dusted heavily with barium carbonate and then pollinated artificially; the remaining four were treated in the reverse order.

The bunches were inspected after an interval of seven weeks. No difference in fruit formation could be detected between the two sets of bunches and other bunches in the same groups of palms which had been merely pollinated artificially. The conclusion is drawn, therefore, that the application of barium carbonate does not inhibit pollination.

Degree of Toxicity of Oil.

The amount of barium carbonate used in dusting averaged 0.14 oz. per inflorescence on the four-year old palms and 0.25 oz. for the ten-year old palms.

Assuming the average weight of a fruit bunch from a four-year old palm to be 12 lbs. and from a ten-year old palm to be 25 lbs. and the conventional factors of 60 per cent. by weight of fruit in the bunch and 25 per cent. by weight recovery of oil from the fruit, the maximum possible percentages of barium carbonate in the oil, assuming all the poison to be retained, correspond to 1 part in 206 and 240 parts of oil respectively.

On theoretical grounds it may be predicted that, even if all the barium carbonate is retained by the bunch until it reaches the factory, the greater part of the poison will be removed with the sludge. To test this prediction, a quantity of crude oil (mixture of oil, sludge and water) from the centrifugal extractor was weighed, and barium carbonate added in the proportion of 1 part to 200 parts of the liquid.

The liquid was boiled with steam for 2 hours, allowed to settle overnight, the supernatant oil decanted and passed through a coarse filter paper, thereby imitating as nearly as possible the factory process for the purification of the crude oil.

The experiment was repeated with a second batch of crude oil and determinations of barium made in both samples of purified oil.

The results were in close agreement, the mean of the two determinations corresponding to 1 part of barium carbonate in 26,000 parts of oil.

The question of toxicity was referred to the Acting Chief Chemist, Institute for Medical Research, Kuala Lumpur, who stated that in view of the extremely small quantity of barium in the oil and the fact that barium chloride (a soluble barium salt) is given in medicinal doses in amounts up to 1.5 grains, it is extremely improbable that there is any risk of the oil being deleterious to health.

It is just possible that if the oil were ingested daily for a considerable period there might be a cumulative effect, but in view of the presence in foods of sulphates and oxalates, including oxalic acid, with which barium forms insoluble compounds, it is more than probable that any barium ingested with the oil would be excreted as an insoluble compound.

In view, therefore, of the above results, which are based on absolute maxima and would never be obtained in actual practice—for example, no account is taken of any barium carbonate which would be blown away by the wind or washed off by rain—it is not considered that any real danger can accrue as a result of dusting the inflorescences with barium carbonate.

In conclusion, the writers wish to acknowledge the assistance rendered by the Acting Chief Chemist, Institute for Medical Research, Kuala Lumpur.

NOTE ON THE ROOT HABIT OF OIL PALMS

BY

J. LAMBOURNE,

Assistant Agriculturist.

The question of root habit of oil palms has recently been raised in connexion with the manuring of this crop. Opinions appear to differ as to whether manure should be spread over the whole area between mature palms in a plantation or whether it would be more economical to concentrate it in strips or circles at the limit of leaf spread. This raises the following questions :—

(*a*) Do the feeding roots of oil palms take possession of the soil over the entire area between palms, or are they concentrated more or less at the limit of leaf spread?

(*b*) Do roots cease to function and die after a time and, if so, how are they replaced?

In connexion with the above questions the following account of a survey of the root systems of oil palms carried out at the Central Experiment Station, Serdang, is of interest.

The palms used for this survey are eleven years old and growing on flat land where the water table in dry weather is approximately three feet below the surface.

The methods adopted were (*a*) to expose the surface roots to a radius of eighteen feet from the stem and (*b*) to open a trench midway between two palms and up to the base of a third in order to examine the roots at depth.

On exposure of the surface roots it was found that they formed a network over the whole area between palms. Young roots were emerging from the base of the stem and the growing points, *i.e.* feeding or absorbing portion of roots were found at all distances from close to the stem to the limit of exposure. Individual roots were traced with difficulty to distances up to twenty feet from the base of the stem and there is reason to believe that they spread much further. Roots of palms growing in the avenue at the Central Experiment Station, Serdang, have been found at distances up to 62 feet from the palms. It was also found that a certain number of the roots were dead while others, although from superficial appearance alive, were decaying in the centre.

The trench was made 2½ feet wide and 3 feet deep. It was found that comparatively few roots penetrated below three feet and these were mostly branches from main roots; the majority were found in the top eighteen inches of soil. In well-drained soil, roots are known to penetrate to a depth of 12 to 14 feet.

On examination, the roots emerging from the sides of the trench revealed that 71 per cent. were alive and healthy, 19 per cent. were superficially alive but decaying in the centre, and 10 per cent. were dead.

From these observations it is evident that feeding roots are present at all distances up to 20 feet or more from the stem, and, in a plantation of mature palms, roots form a network all over the area. A certain number of roots are constantly dying and young ones are produced from the base of the stem to take their place. In this respect the oil palm differs in no way from other monocotyledonous plants.

The results of this survey would appear to indicate, therefore, that broadcast manuring of oil palm plantations should be practised.

MALACCA VERNACULAR SCHOOLS AGRI-HORTICULTURAL SHOW.

The Malacca Vernacular Schools Agri-Horticultural Show, believed to have been the first show of the kind to be held in Malaya, was held on November 16th, 1935, in the Recreation Hall of the St. Francis Institution, Malacca.

The exhibits comprised vegetables, food crops and horticultural plants, grown in the vernacular school gardens, of which there are approximately 90, in the Settlement.

The schedule comprised, in all, 31 classes, of which 28 were for vegetables and food crops. The total entry approximated to 400 exhibits. Competition was keen in the majority of classes and some excellent exhibits were seen, notably in the classes for brinjals, cucumbers and the various types of bean.

There were non-competitive sections for basketry, book-binding, needlework and other crafts.

In addition to the individual awards for each class, certificates of merit were awarded by the Department of Agriculture to the schools gaining first, second and third places in the grand aggregate of awards.

The awards for the various classes, together with those for the annual school garden competition, judging of which had taken place earlier in the month, were distributed by the Director of Agriculture, S.S. at the conclusion of the Show.

The Show may be adjudged to have been a notable success and will, it is hoped, prove to be the forerunner, in the Settlement, of others equally successful.

INTERNATIONAL GROCERS' EXHIBITION*

Royal Agricultural Hall, Islington. 21st to 27th September, 1935.

This was the 39th Annual Grocery Exhibition and the eighth consecutive occasion upon which Malaya was represented by a Stand. This Exhibition has been described as the world's largest grocery and provision market and attracts large attendances both of the trade and the public, though it is primarily a trade show at which grocers and provision merchants meet their suppliers. Conferences are held in the course of the Exhibition by the various organiza-

* Abstract of the Report of the Deputy Agent, Malayan Information Agency.

tions interested in the trade, and Trade Competitions are held during its course. It provides an excellent opportunity for displaying all forms of grocery goods. Government stands were : Australia, Canada, South Africa, New Zealand, Irish Free State, India, Malaya, The Empire Tea Marketing Board and the Ministry of Agriculture and Fisheries.

The main exhibit on the Malayan stand consisted as usual of representative packs of canned pineapples. Small samples of sago, tapioca, coconut products, nutmegs, etc. were also displayed.

The arrangements of the stand, based on a background composed of pyramids of tins of pineapples in their numerous and gaily coloured labels, formed an attractive trade display. Freshly opened samples were arranged on the demonstration counter, and tins were opened on the spot for grocers and buyers interested in particular packs. Information was given on qualities, prices, the various sizes exported, and the firms handling them. The Exhibition afforded a valuable opportunity to show those in the trade the quality of recent Malayan "Golden" and selected "G.A.Q." packs. Generally speaking, inquirers were highly impressed by the quality of the samples opened for them.

Inquiries as to prices, supplies, etc. were numerous. The direct results are difficult to assess since many of the inquirers buy in lots of a few cases at a time, and these deal not direct with the importing firms but with the second or perhaps third distributors. It is, however, unquestionable that the stand affords excellent publicity for Malayan pineapples at a very low cost.

Reviews.

Diseases of the Banana and of the Manila Hemp Plant.

Wardlaw, C. W. , 615 pp., 292 figs. London, Macmillan & Co. Ltd., 1935. Price 30s. net.

As the author of this well-produced and generously illustrated book points out in his preface, the banana, an important crop throughout tropical and sub-tropical regions, and in some countries the major source of agricultural wealth, is subject to a considerable number of diseases in the field. Furthermore, the fact that the delicate fruit has to be gathered whilst still immature, transported overseas under special conditions in refrigerated holds and finally ripened at a higher temperature, materially extends the pathological aspect. Our knowledge of the diseases involved is far from complete, and precise information regarding control measures, whether economic in application or otherwise, is extremely scanty. Nevertheless, scattered throughout mycological and agricultural literature there exists a very considerable fund of relevant scientific observation. This the author has now brought together and formed into a comprehensive volume which represents a valuable contribution to phytopathological literature.

The diseases are dealt with under four main sections: (1) Soil-borne, vascular and stem diseases (including three chapters on Panama disease, or, as the author prefers to call it, banana wilt, and one chapter on bacterial vascular diseases which contains an account of the two diseases from the Netherlands Indies described by Gaumann, neither of which has yet been observed in Malaya), (2) plantation diseases of fruit, and leaf diseases (with a chapter on physiological diseases), (3) virus diseases and (4) storage diseases.

The volume is completed by the addition of four appendices which comprise a list of the bacteria and fungi associated with the banana as saprophytes and parasites; a descripion of the physiological and morphological characters of six strains of *Fusarium oxysporum cubense;* statistics relating to the importation of bananas into Great Britain, and a report on the conditions obtaining in the holds of ships during the transport of bananas from the Caribbean region to English ports. A bibliography of 559 titles and an index are attached.

R. A. A.

North Borneo Department of Agriculture Annual Report for 1934.

H. G. Keith, Director of Agriculture, State of North Borneo. Government Printing Office, Jesselton, North Borneo. 12 pp. 1935.

The major crops are stated to be padi, rubber, coconuts and sago. The area under padi in the season 1934-35 was 64,885 acres, of which 41,340 acres were under "wet" padi and 23,545 acres under "dry" padi cultivation. The crops in 1934 were approximately 22,367 tons from the "wet" area and 8,353 tons from the "dry" area. There are 13 rice mills operating. The total area under rubber was 128,590 acres, of which 70,868 acres were on estates of over 100 acres each and 57,722 acres on holdings of under 100 acres each. Production during the year amounted to 6,242 tons. The area under coconuts was 51,026 acres, production being 7,010 tons of copra, 855 tons of oil and 3,893,917 nuts. The sago area was 13,988 acres; the crop harvested amounted to 1,500 tons, a decrease of 40 per cent. in comparison with the previous year, while exports also showed a decline due to low market prices.

Of minor crops, the one surviving tobacco estate closed down during the year, while the manufacture of native and Chinese cigars is reported to have decreased to a considerable extent. Pepper exports were 16,295 lbs.; there was a considerable increase in the area planted with this crop and also in production in 1934. The first shipment of graded pepper was successfully marketed by the Department in the United Kingdom and Hongkong.

There are several soap factories in operation. The amount of soap manufactured from locally-produced coconut oil shewed a considerable increase, the total output being 114,669 lbs. Tallow used in the manufacture of soap is imported from Hongkong and Dutch Borneo. The locally-manufactured soap is of good quality and is now sold generally throughout the Territory.

In addition, the report gives information of agricultural pests which had proved troublesome and the methods used to combat their ravages, and details of the work conducted at the Agricultural Experiment Station which was chiefly concerned with the introduction and acclimatization of plants and animals, and the distribution of plants, seeds and stock.

D. H. G.

Departmental.

FROM THE DISTRICTS.

Compiled by the Chief Field Officer from Monthly Reports submitted by Field Officers.

November, 1935.

The Weather.

The weather during November was normally cool and wet on most of the western side of the Peninsula with an average and well distributed rainfall. Precipitation was, however, somewhat above the average in Kedah, Penang and Perak North, while in the Jelebu and Tampin Districts of Negri Sembilan and the inland parts of Malacca and Johore it was noticeably deficient. On the eastern side in Kelantan the first half of the month was warm and dry, but in the second half the cool wet conditions characteristic of the north east monsoon were experienced. The rainfall in Kelantan and in Kuantan District of Pahang was only about half the average, while on the east coast of Johore the weather was very dry, as the monsoon had not broken. There were minor floods causing no serious damage in Kedah and parts of Negri Sembilan.

Remarks on Crops.

Padi.—There was little change in the price of padi. The only localities where transplanting was still in progress were parts of Province Wellesley, the Panchang Bedena area in Selangor and the coastal padi fields in Pekan and Kuantan Districts.

The growing crop made good progress in practically all districts and but little damage was done by floods or deep water resulting from heavy rains, but in the Panchang Bedena area, as in the Sungei Manik area, prevailing wet conditions showed clearly that the construction of bunds by land owners on their own properties is essential to fully effective water control. In Larut Districts those padi cultivators who missed the proper planting dates were prevented by deep water from completing work on clearing and planting their land, so that it is doubtful if they will secure a crop this season.

In Kelantan both wet and dry padi were doing well after the advent of rain, the latter crop making a remarkable recovery from the effect of the earlier drought. The short term wet padi grown in the low lying areas was harvested in good condition.

Reaping was in progress throughout the month in the Jelebu District of Negri Sembilan, in all padi fields along the Pahang river below Kuala Lipis and also in Bentong District. Throughout Jelebu District the crop suffered considerable damage from stem borers. Yields in the riverine mukims of

Pahang up to the present have on the whole been satisfactory, when allowance is made for the dry conditions experienced earlier in the season.

In Batu Pahat, Kluang and Pontian Districts in Johore the crop has been reaped. Yields have been low owing to damage by pests, such as rats and birds, and to unsuitable conditions.

Harvest commenced in a few places in North Kedah, in the inland areas of Selangor, the Raub Districts of Pahang and the Segamat District of Johore.

It is recorded that reaping is being done with the sickle (sabit) by some growers in Temerloh District, as a result of their visit to Malacca. The sickle was also being used in Segamat District owing to a desire to complete the harvest quickly before the commencement of the fasting month.

A supply of 17 piculs of padi for the Temerloh mill was purchased at $2 per picul and the safe harvesting of this year's crop is expected to render further supplies available.

Rubber.—There was a further rise in the price of rubber of about $1 per picul. The price of export coupons without rubber rose by about $1.50 to $20.50 per picul of export rights in most parts of the country, but in Johore the price of these coupons was $21 to $22. The highest local price for smoked sheet was $28 per picul and for unsmoked sheet $27 per picul, but rather wet rubber without coupons sold for only $4 per picul.

There was a marked increase in the number of holdings on which tapping was suspended; this was due to three causes, wet weather, exhaustion of coupons, and the high price offered for coupons. This price rendered the sale of coupons more profitable in many areas than was the production of sheet rubber, which, if not smoked, was difficult to dry.

The response of small-holders to the teaching of the Asiatic Rubber Instructors on the preparation of good quality smoked sheet is variable, owing to the effect of several factors of which the majority are adverse in many areas. The normal difference in price between well dried unsmoked sheet and smoked sheet is about $1 per picul. At present prices this difference is not attractive to the small-holder when allowance is made for the fact that smoked sheet takes 3 or 4 days longer to prepare than does unsmoked sheet. In Pahang, moreover, the price difference is as low as 50 cents per picul, while the lowest price for smoked may be less than the highest price for unsmoked sheet. Other adverse factors are the exhaustion of coupons and the prevailing high price for coupons. On the other hand in wet weather conditions, when unsmoked sheet is difficult to dry, good smoked sheet may sell for $2 per picul more than the unsmoked, a sufficent difference to prove attractive. In spite, however, of these adverse factors, eight new smoke cabinets were constructed, one of these in Kuantan District being the first in eastern Pahang and the outcome of transferring the Instructor to this District.

In Johore North it was found that the usual retail price of formic acid coagulant was unduly high. In consequence Departmental sales of correctly diluted acid in small bottles at cost price have been instituted.

Coconuts.—In Province Wellesley, Krian and Selangor there was a shortage of nuts for copra making and prices were higher, being as much as $20 per 1,000 for export from Penang to Burma. The shortage was due in part to seasonal decline in yields and in part to the increased consumption of fresh nuts by Malays during the fasting month. In Johore this temporary increased consumption led to the export of fresh nuts from the western coastal areas to the inland towns, but in spite of this, interest in copra production was well maintained, particularly around Senggarang, Benut and Kukup. On the improved kiln at Ringgit 56 piculs of copra were made, which sold for $5.60 per picul in Singapore.

In Pahang East also a seasonal decline in nut yields was recorded rendering nuts scarce, but this shortage did not prevent the new improved kiln at Tanjong Medan from commencing work and producing copra of fair quality.

It was reported from Bagan Datoh District and Kelantan that the difficulty of drying copra during the wet weather caused a decline in the quality of the product. This naturally led to a wider margin between the local prices and those in the markets of Penang and Singapore. It is further reported that small-holders in Kelantan frequently store their nuts during the wet season.

Pineapples.—Increased supplies of pineapples for canning became available in Johore where five factories were working. On the whole, however, the season's crop of fruit is light and prices have been high ranging from $2.50 to $4.00 per hundred for first quality, $2 to $3.50 second quality and 90 cents to $2.25 for third quality fruits. A considerable part of the crop from the coastal Districts of Selangor was exported to Singapore by sea and rail, as prices there were attractive even after payment of freight charges. Of the light crop in Negri Sembilan some 800 piculs of fruit were exported, part going to the Klang factory.

Fruits.—Kwini were fruiting in Kuantan District and selling for 70 to 80 cents a hundred on the Kuantan market. Mempelam were obtainable in Bentong District, in parts of Selangor and in Perak North, the usual price being 2 to 3 cents each. Light crops of mangosteen, durian, rambutan and jambu were obtained from the earlier areas in Selangor, while durians were also harvested in parts of Negri Sembilan and rambutans in Perak North. Durians sold for 15 to 20 cents each and rambutans at prices varying from 20 to 60 cents per 100. Durians from Negri Sembilan were on sale in the Malacca market.

Tobacco.—The crop was harvested in Province Wellesley and Penang, where 62 piculs of dried leaf were obtained, and also in Malacca and Batu Pahat District of Johore. The price declined slightly in most areas, but remained high in Pahang.

Tuba.—In Temerloh District 200 acres have been planted with this crop at Kerdau. It is reported from Johore that small-holders in the Kahang mukim of Endau District are deriving a steady income from the sale of cut-

tings to cultivators in other parts of the State. Many thousands of cuttings have also been despatched to European and Asiatic cultivators in Perak and elsewhere. There was no sign of any decline of interest in this crop with which a number of holdings in Kluang District were planted during the month. Prices of dried root remained fairly steady and there was no difficulty in effecting sales.

Cloves.—Penang cloves were being harvested during the month. Prices were, however, very low; local dealers bought fresh cloves on the growers' holdings at prices ranging from $8 to $10 per picul, while dried cloves were sold at prices ranging from $30 to $40 per picul. Sundrying was rendered difficult by almost daily rain and there was a tendency for the cloves to darken in colour and in consequence to decline in value.

Agricultural Stations and Padi Test Stations.

Various works for facilitating water distribution and control were completed on the Sungei Manik Padi Test Station and transplanting was commenced. Transplanting was also in progress on the Sungei Blat Padi Station where water supplies were good and growth was satisfactory. Harvest was in progress on the Kuala Klawang Test Plot in Negri Sembilan, the Temerloh Test Plot in Pahang and the Jementah Test Plot in Johore. Damage by stemborers was somewhat severe at Kuala Klawang, while strong winds caused lodging of some of the early Radin Siak strains at Jementah. The Kuang Plot in Selangor, in common with the surrounding padi fields, suffered considerable damage from rats, in spite of all precautions.

A very heavy fall of over 3 inches of rain on the afternoon of November 23rd caused heavy flooding of the lower lying portions of the Bukit Mertajam Station in Province Wellesley. Beds of rotation crops and nursery plants were washed away and covered with a deposit of sand. At the Selama Station rambutans were successfully budded. There was a slight outbreak of Pink disease (*Corticium salmonicolor*) on robusta coffee at this Station.

Agricultural Instruction.

Judging for the School Gardens Competitions in most States and Settlements has been in progress during the last two months and was completed before the schools broke up for the holidays during the fasting month. In general the judges were well satisfied with the standard of upkeep shown.

In Pahang Central and Selangor judging of home gardens was in progress and in these also the standard attained was satisfactory.

At the weekly fair at Kubang Pasir in Kedah on November 7th, a Vegetable Show was held at which vegetables grown by school children in their school or home gardens were displayed, together with exhibits of various handicrafts made at school or at home. A somewhat similar exhibition was

held at the Kelawei Malay School in Penang Island. The Malay Schools Agri-Horticultural Show held in Malacca on November 16th is described elsewhere in this number.

The Rural Lecture Caravan completed its successful tour in Negri Sembilan.

The Agricultural Officer, Krian, arranged a visit for the local headmen from the Bagan Serai mukim of Krian District to the Government Rice Mill on November 12th. With the assistance of the Manager the operation of milling was explained and the importance of evenness of grain size and ripeness stressed. A long and useful discussion followed.

The State Agricultural Officer, Johore, and the Agricultural Officer, Johore North, gave a demonstration to padi growers at the Jementah Padi Test Plot on November 12th. This was attended by some 70 padi growers and considerable interest was aroused. Special attention was directed to the short term strains of Radin Siak which should prove suitable in several areas in the Segamat District where irrigation facilities are not available. Various implements together with materials for control of insect pests were on view and their use was explained.

DEPARTMENTAL NOTES.

Visit of the Adviser on Agriculture.

The Adviser on Agriculture visited Malacca from 16th to 18th November. On the 16th he attended the Malacca Vernacular Schools Agri-Horticultural Show. On the following two days he inspected the Agricultural Stations in Malacca, and the Departmental activities in the Sub-district of Rembau and at Seremban.

Appointments.

Mr. N. H. Sands, Dip. Agr. (Wye), has been appointed to be an Agricultural Officer, Department of Agriculture, Straits Settlements and Federated Malay States, with effect from 3rd March, 1935 inclusive.

Mr. C. W. S. Hartley, B.A., Dip. Agric. (Cantab.), has been appointed to be an Agricultural Officer, Department of Agriculture, S.S. and F.M.S., with effect from 12th October, 1935. Mr. Hartley arrived on 7th November, 1935.

Agricultural Advisory Committee.

A meeting of the Agricultural Advisory Committee was held at the Department of Agriculture, Kuala Lumpur, on 13th November, 1935. The progress of the work of the Department since the last meeting was reviewed and consideration given to future developments. Among subjects which engaged the attention of the meeting were: improvements of Malayan copra, the position in relation to copra research and market intelligence service for small-holders; pineapple research; organization to deal with rice research; the work of the Small-holders' Rubber Advisory Service.

The meeting was informed that His Excellency the Governor had suggested that it would be useful and would make for inter-departmental co-operation, if the Veterinary Adviser were invited to become a member of the Agricultural Advisory Committee. The Committee agreed that this was a very desirable step.

Change of Title.

The title of Vice-Principal of the School of Agriculture, Malaya, will be abolished as from 1st January 1936.

Hitherto the Director of Agriculture has been Principal of the School. Under the new arrangement, the Director will remain primarily responsible, but he will confine himself to the measure of general supervision which he normally exercises over the Branches of the Department.

Mr. G. E. Mann, at present Vice-Principal, will then become Principal of the School.

Leave.

Mr. N. C. E. Miller, Assistant Entomologist, returned from leave on 8th November, 1935.

During his leave, Mr. Miller represented the Malayan Governments at the Fourth Imperial Entomological Conference held in London from 19th to 28th September, 1935. He also acted in a similar capacity at the 6th International Conference held in Madrid from 6th to 12th September, 1935.

Statistical.

MARKET PRICES.

November, 1935.

Rubber.—The improvement in this market which took place in October was maintained during the first half of November, but thereafter prices weakened slightly. Spot loose opened in Singapore at 22⅛ cents per lb. and closed at 21⅛ cents, the average price for No. 1. X. Rubber Smoked Sheet being 21.88 cents per lb. as compared with 20.78 cents in October. The average price in London for November was 6.31 pence per lb. and in New York 13.08 cents gold per lb. as compared with 6.12 pence and 12.54 cents gold in October.

The following table shews the prices paid for small-holders' rubber at three centres during November.

Table I.
Weekly Prices Paid By Local Dealers for Small-Holders' Rubber, November, 1935.

(Dollars per Picul.)

Grades.	Kuala Pilah, Negri Sembilan.				Kuala Kangsar, Perak.				Batu Pahat, Johore.	
	7	14	21	28	6	13	20	27	6	13
Smoked sheet	27.03		26.78		26.59	26.80	27.00	25.00		
Unsmoked sheet	25.97	26.00	25.00	25.43	26.00				25.00	25.00
Scrap										

Transport by F. M. S. R. lorry service Kuala Pilah to Seremban 12 cents per picul, to Malacca excluding duty, 25 cents per picul, by rail Seremban to Penang $1.24 per picul, Seremban to Singapore $8.00 per ton.

Transport from Batu Pahat to Singapore by lorry excluding duty, 90 cents per picul.

Transport from Kuala Kangsar to Prai by railway $6.20 per ton.

Transport from Kuala Kangsar to Singapore by railway $10.00 per ton (minimum consignment 5 tons).

At Kuala Pilah the standard deduction for moisture in unsmoked sheet is 5 per cent.

At Kuala Kangsar the standard deduction for moisture in unsmoked sheet is 10 per cent

No purchases at Batu Pahat on the 20th and 27th November.

Palm Oil.—The following table shews the fluctuations in the market for the Malayan commodities during November.

Table II.

Prices of Palm Oil and Palm Kernels.

Date 1935.	Palm Oil in Bulk, c i.f. landed weight Liverpool/ Halifax.	Palm Kernels, c.i.f. landed weight London/ Continent
	per ton	per ton
Nov. 1	20. 15. 0	10. 0. 0
„ 8	20. 10. 0	10. 0. 0
„ 15	20. 0. 0	9. 10. 0
„ 22	20. 10 0	10. 2. 6
„ 29	21. 0 0	10. 5. 0

Copra.—The market maintained its higher level, and improved still further towards the end of November, the price for the sun-dried grade ranging between $5 and $5.35 per picul. The Singapore average price for the month was $5.22 as compared with $4.91 in October. The mixed quality followed the trend of the better grade, and averaged $4.67 per picul as compared with $4.41 in the previous month.

Copra cake weakened slightly, the average for the month being $1.55 per picul as compared with $1.66 in October.

Rice.—The average wholesale prices of rice per picul in Singapore for October were as follows:—Siam No. 2 (ordinary) $4.37, Rangoon No. 1 $3.86, Saigon No. 1 $3.82, as compared with September corresponding prices of $4.29, $3.72 and $3.77. The October 1934 corresponding prices were $3.14, $3.15 and $3.05.

The average retail market prices in cents per gantang of No. 2 Siam rice in October were:— Singapore 32, Penang 32, Malacca 29, as compared with 32, 26 and 29 respectively in September.

The average declared trade value of imports of rice in October was $3.80 per picul, as compared with $3.59 in September and $3.72 in August.

Padi.—The Government Rice Mill at Bagan Serai paid $2.20 per picul for padi during November, and the Parit Buntar mill paid $2 to $2.20 per picul. Retail prices per gantang ranged from 8 to 14 cents, but in Krain they were only 6 to 9 cents and in Kelantan 6½ cents.

Tea.—Eleven consignments of Malayan tea were sold on the London market during November and including the last week of October. Two consignments were of highland tea, and averaged 1s. 0¼d. and 1s. 1d. per lb.; the remaining consignments were of lowland tea, and prices ranged from 10½d. to 1s.0d. per lb.

Average London prices per lb. during November for tea consignments from other countries were as follows:—Ceylon 1s. 2.22d., Java 1s. 0.40d., Indian Northern 1s. 0.95d., Indian Southern 1s. 0.24d., Sumatra 9.90d.

The latest Colombo average prices available are quoted from the *Weekly Tea Market Report*, 26th November, 1935; of the Colombo Brokers' Association and are as follows (rupee cents per lb.):—High Grown Teas 73 cents, Medium Grown Teas 66 cents, Low Grown Teas 62 cents.

Tuba Root (Derris).—The Singapore market weakened considerably during November owing to lack of buying demand from abroad. Roots sold on rotenone content averaged $48 per picul as compared with $51 in October; roots sold on a basis of either extract fell to $32.50 per picul from the previous month's average of $37. Non-Malayan roots were nominally $20 per picul; the October average price was $25.

Coffee.—There was only a slight change in prices in Singapore, Sourabaya coffee averaging from $13.44 to $14.56 per picul, as compared with $13.25 to $14.25 in October. Palembang coffee continued unchanged at $7.50 per picul.

Locally-grown coffee ranged in price from $16 to $30 per picul, but in Johore the robusta variety was quoted as low as $10 to $14 per picul.

Arecanuts.—Prices weakened still further in Singapore during November. Average prices per picul were:— Splits $4.12 to $6.69; Sliced $6.75 to $8.87; Red Whole $5 to $6.25; the prices in each range depending upon quality.

The Singapore Chamber of Commerce average prices per picul were:— Best $6.95, Medium $6.40, Mixed $5.50.

Gambier.—There was a further advance in the Singapore market, Block averaging $6.60 per picul, and No. 1 Cube $10.10, as compared with $6 and $10 respectively in October.

Pineapples.—The Packers' Combine reduced their prices during the month, and average prices per case were:— Cubes $3.99, Sliced Flat $3.61, Sliced Tall $3.78. The October average prices were $3.95, $3.69, and $3.95 respectively.

Fresh fruit prices per 100 in Johore were: 1st quality $2.50 to $4, 2nd quality $2 to $3.50, 3rd quality 90 cents to $2.25. In Selangor the price for fresh fruit was only 90 cents per 100.

Tapioca.—The Singapore market weakened at the close of the month, and average prices per picul were:— Flake Fair $5.90, Seed Pearl $5.90, Medium Pearl $6.80, as compared with $5.62, $5.94 and $6.88 respectively in October.

Sago.—This market also weakened in November, average prices in Singapore per picul being:—Pearl, Small Fair $3.95, and Flour, Sarawak Fair $2.83, as compared with $4.50 and $2.96 respectively in the previous month.

Mace.—Siouw fell during the month and averaged $117 per picul, but Amboina remained unchanged at the October closing price of $65. The October average prices were $117.50 and $63.75 per picul respectively.

Nutmegs. The Singapore market weakened during November but the average prices per picul were higher than those of the previous month; they were :— 110's $36, and 80's $37, as compared with $34.75 and $35.75 in October.

Pepper.—In the absence of buying enquiry prices were nominal and lower than the October levels. Singapore average prices in November per picul were : Singapore Black $9.70, Singapore White $17.50, Muntok White $18.30, as compared with $10.62, $18.62 and $19.50 respectively in the previous month.

Cloves.—Nominal quotations were reduced at the close of November and average prices per picul in Singapore for both Zanzibar and Ambonia were $37.60, as compared with $38 in October.

Cardamoms.—Green cardamoms were quoted during November in the Ceylon Chamber of Commerce weekly reports at 98 rupee cents to R. 1.20 per lb. falling slightly to 98 cents to R. 1.18 per lb.

Tobacco.—As usual, there was considerable variation in prices quoted in different parts of the Peninsula. In Johore prices were low, ranging from $8 to $25 per picul. Prices per picul elsewhere ranged as follows : 1st quality $25 to $64, 2nd quality $17 to $40, 3rd quality $10 to $20.

The above prices are based on London and Singapore daily quotations for rubber; on the Singapore Chamber of Commerce Weekly Reports for the month and on other local sources of information. Palm oil reports are kindly supplied by Messrs. Guthrie & Co. Ltd., Kuala Lumpur; the Singapore prices for coffee and arecanuts by the Lianqui Trading Company of Singapore, and tuba prices by Messrs. Mackay & Co., Singapore.

1 picul = 133⅓ lbs. The Dollar is fixed at two shillings and four pence.

Note.—The Department of Agriculture will be pleased to assist planters in finding a market for agricultural produce. Similar assistance is also offered by the Malayan Information Agency, 57, Charing Cross. London, S.W.1.

GENERAL RICE SUMMARY.*

October, 1935.

Malaya.—Imports of foreign rice during October were 74,941 tons; exports were 20,462 tons, net imports being 54,479 tons. The total of net imports for the period January to October, 1935, was 407,949 tons, an increase of 5.9 per cent. as compared with 385,304 tons in 1934.†

Of the October imports, 51 per cent. were consigned to Singapore, 14 per cent. to Penang, 7 per cent. to Malacca, 21 per cent. to the Federated Malay States, and 7 per cent. to the Unfederated Malay States. Of the total, 63 per cent. came from Siam, 30 per cent. from Burma, 6 per cent. from French Indo-China, and 1 per cent. from other countries.

Of the exports during October, 69 per cent. were consigned to the Netherlands Indies, and 31 per cent. to other countries. The various kinds of rice exported were: Siam 15,810 tons (77.3 per cent.), Burma 2,994 tons (14.6 per cent.), French Indo-China 1,528 tons (7.5 per cent.), parboiled rice 28 tons (0.1 per cent.), local production 102 tons (0.5 per cent.).

India and Burma.—Foreign exports for the period January to September, 1935, totalled 1,416,000 tons, an increase of 18.6 per cent. as compared with 1,194,000 tons in 1934. Of the 1935 exports 4.2 per cent. were to the United Kingdom, 10.5 per cent. to the Continent of Europe, 23.7 per cent. to Ceylon, 31.9 per cent. to the Straits Settlements and the Far East, and 29.7 per cent. to other countries. The corresponding 1934 percentages were: 9.1, 19.1, 23.8, 19.4 and 28.6.

Burma's total exports of rice and bran (*Bangkok Times*, 4th November, 1935) from 1st January to 28th September, 1935, aggregated 2,910,960 metric tons, as compared with 3,247,874 metric tons in 1934, a decrease of 10.4 per cent.

According to the first rice forecast for All India for the season 1935-36 (*Indian Trade Journal*, 7th November 1935), the total area sown is reported to be 74,082,000 acres, a decrease of 2 per cent. as compared with the corresponding estimate for the previous season. The area in Burma likely to mature is estimated to be 0.9 per cent. less than in the 1934-35 season.

Siam.—Exports of rice and rice products from Bangkok during September were 112,923 tons, (provisional). The cumulative total for the year is 1,122,564 tons as compared with 1,345,111 in 1934.

The first report on the 1935 rice crop states that it is now estimated that the exportable surplus will not exceed 1,800,000 metric tons, a considerable reduction when compared with the original estimate of 1,900,000 metric tons.

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* Abridged from the Rice Summary for October, 1935, compiled by the Department of Statistics, Straits Settlements and Federated Malay States.

† It is to be understood throughout the summary that all comparisons and percentage increases or decreases are in relation to the corresponding period of 1934.

Japan.—The second estimate of the 1935 rice crop now places it at 8,002,767 as compared with the 1934 actual crop of 7,271,000 tons, an increase of 10.1 per cent.

It is estimated that the Formosan 1935 crop will show an increase of 9.8 per cent. in production as compared with 1934.

French Indo-China.—Entries of padi into Cholon during the first ten months of the year totalled 1,521,822 metric tons as compared with 1,360,720 metric tons in 1934, an increase of 11.8 per cent. Exports of rice for the same period were 1,580,723 tons, an increase of 24.2 per cent.

The Netherlands Indies.—Imports of rice into the Netherlands Indies during the period January to July 1935, totalled 267,371 metric tons as compared with 107,414 metric tons for the corresponding period of 1934, an increase of 149 per cent.

Ceylon.—Imports for the first ten months of 1935 amounted to 444,392 tons, an increase of 13.6 per cent. as compared with 1934.

Of the imports 12.9 per cent. were from British India, 68.2 per cent. from Burma, 0.8 per cent. from the Straits Settlements, and 18.1 per cent. from other countries. The corresponding 1934 percentages were 14.4, 62.0, 1.4, and 22.2.

Europe and America.—Shipments from the East to Europe during the period 1st January to 17th October aggregated 678,883 tons, as compared with 1,022,995 tons in 1934, a decrease of 33.6 per cent. Of these shipments 47.2 per cent. were from Burma, 3.5 per cent. from Japan, 42.3 per cent. from Saigon, 5.4 per cent. from Siam, and 1.6 per cent. from Bengal. The 1934 corresponding percentages were 37.0, 4.6, 46.7, 9.6, and 2.1.

Shipments for the Levant from 1st January to 26th September 1935 totalled 26,634 tons, an increase of 9.2 per cent. as compared with 1934.

Shipments for Cuba, West Indies and America from 1st January to 29th September, 1935, amounted to 191,460 tons, an increase of 21.3 per cent. over the previous year.

MALAYAN AGRICULTURAL EXPORTS, OCTOBER, 1935.

PRODUCT.	Net Exports in Tons.				
	Year 1934.	Jan-Oct. 1934	Jan-Oct. 1935	October 1934	October 1935
Arecanuts ...	27,336	23,840	18,702	817	2,670
Coconuts, fresh † ...	100,804†	84,288†	90,623†	11,922†	11,665†
Coconut oil ...	25,485	20,698	28,270	2,350	3,701
Copra ...	95,599	76,627	84,043	9,951	6,079
Gambier, all kinds ...	2,170	1,827	2,440	229	372
Oil cakes ...	11,273	9,777	8,902	1,522	1,524
Palm kernels ...	3,196	2,624	3,118	547	526
Palm oil ...	15,852	13,182	19,051	2,943	2,255
Pineapples canned ...	66,634	59,230	59,159	2,393	3,790
Rubber ¶ ...	479,371¶	385,956¶	326,731¶	34,075¶	34,588¶
Sago,—flour ...	10,403	6,631	7,945	1,071	1,435
„ —pearl ...	5,058	4,084	3,939	533	460
„ —raw ...	7,079*	5,526*	6,089*	790*	940*
Tapioca,—flake ...	5,761	5,138	1,625	199	193
„ —flour ...	1,842*	1,656*	524*	180*	7
„ —pearl ...	15,770	13,246	15,042	1,169	2,023
Tuba root ...	481	446½	469	24½	39

† hundreds in number. * net imports. ¶ production.

MALAYAN PRODUCTION (IN TONS) OF PALM OIL AND KERNELS

(As declared by Estates)

Month 1935	Palm Oil		Palm Kernels	
	F.M.S.	U.M.S.	F.M.S.	U.M.S.
January, ...	1,062.3	339.3	174.0	49.6
February ...	977.4	220.9	161.7	38.5
March ...	1,104.3	334.2	172.6	48.6
April ...	1,008.2	328.0	151.2	40.4
May ...	1,077.1	461.8	158.6	63.1
June ...	1,311.0	724.1	200.9	105.5
July ...	1,901.2	729.0	255.3	109.0
August „ ...	2,331.5	777.9	345.5	120.0
September ...	2,080.0	607.4	231.3	87.7
October „ ...	1,869.8	512.8	306.5	54.4
Total ...	14,722.8	5,035.4	2,157.6	716.8
Total Jan. to Oct. 1934 ...	10,572.5	3,655.7	1,683.0	661.7
Total for year 1934 ...	12,965.0	4,510.0	2,013.0	795.0

ACREAGES OF TAPPABLE RUBBER NOT TAPPED ON ESTATES OF 100 ACRES AND OVER, FOR THE MONTH ENDING 31ST OCTOBER, 1935.

STATE OR TERRITORY	Acreage of Tappable Rubber end 1934	ESTATES WHICH HAVE ENTIRELY CEASED TAPPING		ESTATES WHICH HAVE PARTLY CEASED TAPPING (*a*)		AREA OF TAPPABLE RUBBER NEVER BEEN TAPPED		Total (3) + (5)	Percentage of (9) to (2)
		Acreage	Percentage of (3) to (2)	Acreage	Percentage of (5) to (2)	Acreage	Percentage of (7) to (2)		
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
STRAITS SETTLEMENTS :—									
Province Wellesley	44,691	484	1.1	13,544	30.3	717	1.6	14,028	31.4
Malacca	123,793	1,693	1.4	27,769	22.4	3,467	2.8	29,462	23.8
Penang Island	2,593	—	—	394	15.2	123	4.7	394	15.2
Singapore Island	33,312	3,715	11.1	8,681	26.1	629	1.9	12,396	37.2
Total S.S. ...	204,389	5,892	2.9	50,388	24.6	4,936	2.4	56,280	27.5
FEDERATED MALAY STATES :—									
Perak	295,895	11,079	3.7	58,184	19.7	12,338	4.2	69,263	23.4
Selangor	345,100	10,942	3.2	57,576	16.7	12,964	3.8	68,518	19.9
Negri Sembilan	258,381	11,813	4.6	43,395	16.8	13,770	5.3	55,208	21.4
Pahang	75,912	9,674	12.7	22,597	29.8	12,898	17.0	32,271	42.5
Total F.M.S. ...	975,288	43,508	4.5	181,752	18.6	51,970	5.3	225,260	23.1
UNFEDERATED MALAY STATES :—									
Johore	417,633	17,628	4.2	64,809	15.5	38,975	9.3	82,437	19.7
Kedah	199,180	3,880	1.9	22,423	11.3	19,349	9.7	26,303	13.2
Kelantan	28,891	403	1.4	8,084	28.0	5,289	18.3	8,487	29.4
Trengganu (*b*)	4,643	Nil	Nil	15	0.3	5	0.1	15	0.3
Perlis (*c*)	1,206	Nil	Nil	395	32.8	25	2.1	395	32.8
Brunei	(*d*) 4,991	Nil	Nil	1,678	33.6	844	16.9	1,678	33.6
Total U.M.S. ...	656,544	21,911	3.3	97,404	14.9	64,487	9.8	119,315	18.2
TOTAL MALAYA ...	1,836,221	71,311	3.9	329,544	17.9	121,393	6.5	400,855	21.8

Notes :—(*a*) Area out of tapping on Estates which have partly ceased tapping refers to areas definitely being rested and excludes areas on any tapping round.
(*b*) Registered Companies only.
(*c*) Rendered quarterly.
(*d*) Acreage of tappable rubber on 1st May, 1934.

MALAYA RUBBER STATISTICS — TABLE I

STOCKS, PRODUCTION, IMPORTS AND EXPORTS OF RUBBER, INCLUDING LATEX, CONCENTRATED LATEX AND REVERTEX, FOR THE MONTH OF OCTOBER, 1935, IN DRY TONS.

State or Territory	Stocks at beginning of month 1			Production by Estates of 100 acres and over		Production by Estates of less than 100 acres estimated 2		Imports				Exports including re-exports				Stocks at end of month			Consumption 3	
								during the month		Jan. to Oct. inclusive 1935		during the month		Jan. to Oct. inclusive 1935						
	Ports	Dealers	Estates of 100 acres and over	during the month	January to Oct inclusive 1935	during the month	January to Oct. inclusive 1935	Foreign	From Malay States & Labuan	Foreign	From Malay States & Labuan	Foreign	Local	Foreign	Local	Ports	Dealers	Estates of 100 acres and over	during the month	January to Oct. inclusive 1935
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
MALAY STATES :—																				
Federated Malay States ...	...	7,017	11,719	10,099	111,570	7,997	61,362	Nil	Nil	17	Nil	13,096	4,495	*141,200 †129,250	39,705	...	8,932	10,300	9	91
Johore ...	...	1,144	4,164	4,049	41,383	4,107	32,825	Nil	13	Nil	156	2,545	5,393	25,778	47,262	...	1,884	3,655	...	...
Kedah ...	...	126	2,990	2,236	25,501	1,337	9,682	Nil	Nil	Nil	Nil	1,598	2,472	15,229	19,103	...	319	2,300	...	...
Perlis ...		22	12	9	106	32	193	Nil	Nil	Nil	Nil	Nil	30	Nil	293	...	34	11	...	...
Kelantan ...	...	227	382	327	3,346	1,062	4,976	Nil	Nil	Nil	Nil	198	984	1,726	6,168	...	488	274	...	...
Trengganu ...	...	55	50	223	2,669	111	1,335	Nil	Nil	Nil	Nil	Nil	334	Nil	4,004	...	55	50	...	...
Brunei	...	4	41	60	509	86	598	...	...	...	...	...	142	...	1,084	...	11	38	...	...
Total Malay States	...	8,595	19,304	17,003	185,084	14,732	110,971	Nil	13	17	156	17,437	13,850	183,933	117,619	...	11,723	16,628	9	91
S. SETTLEMENTS :-																				
Malacca ...	...	1,839	1,378	1,070	12,524	733	6,560	Nil		Nil		2,426		26,585		...	2,330	1,021	...	...
Province Wellesley	...	1,619	529	412	4,734	276	2,443	Nil		Nil		7,905		75,214		...	1,931	427	...	...
Penang ...	2,267	6,524	9	14	163	152	1,075	2,319	13,116	21,647	116,751		Nil		Nil	2,869	5,968	10	...	...
Singapore ...	2,483	22,598	171	147	1,805	39	1,227	16,963		134,070		20,490		223,602		4,617	24,143	166	38	396
Labuan	...	45	Nil	Nil	Nil	10	145	82		871		Nil		Nil		...	35	Nil	...	...
Total Straits Settlements	4,750	32,625	2,087	1,643	19,226	1,210	11,450	19,364	13,116	156,588	116,751	30,821	Nil	325,401	Nil	7,486	34,467	1,624	38	396
TOTAL MALAYA	4,750	41,220	21,391	18,646	204,310	15,942	122,421	19,364	13,129	156,605	116,907	48,258	13,850	509,334	117,619	7,486	46,130	18,252	47	487

*Ocean shipments from Malaya of rubber directly consigned from the F.M.S. † Exports of rubber from the F.M.S.

TABLE II
DEALERS' STOCKS, IN DRY TONS 3

Class of Rubber	Federated Malay States	S'pore	Penang	Province We'sly D'dings M'cca.	Johore	Kedah
22	23	24	25	26	27	28
DRY RUBBER	8,058	23,259	5,479	4,180	1,506	190
WET RUBBER	874	884	489	127	378	129
TOTAL ...	8,932	24,143	5,968	4,307	1,884	319

TABLE III
FOREIGN EXPORTS

PORTS	For month	January to Oct. 1935
29	30	31
Singapore ...	31,137	334,524
Penang ...	11,516	116,111
Port Swettenham.	5,346	55,039
Malacca ...	259	3,660
MALAYA ...	48,258	509,334

TABLE IV
DOMESTIC EXPORTS 4

AREA	For month	January to Oct. 1935
32	33	34
Malay States ...	31,287	289,301
Straits Settlements	3,247	29,839
MALAYA ...	34,534	319,140

Notes:—
1. Stocks on estates of less than 100 acres and stocks in transit on rail, road or local steamer are not ascertained
2. The production of estates of less than 100 acres is estimated from the formula: Production + Imports + Stocks at beginning of month = Exports + Stocks at end of month, + Consumption, *i.e.*, Column [7] = Columns [13] + [15] + [17] + [18] + [19] + [20] − [2] − [3] − [4] − [5] − [9] − [10]. For the Straits Settlements the production of estates of less than 100 acres is represented by sales or exports as shown by cess paid.
3. Dealers' stocks in the Federated Malay States are reduced to dry weights by the following fixed ratios: unsmoked sheet, 15% wet sheet, 25% scrap, lump, etc., 40%; stocks elsewhere are in dry weights as reported by the dealers themselves.
4. Column (33) and (34) represent exports of rubber subject to regulation which, for Singapore and Penang Islands are represented by sales or exports as shown by cess paid.
5. All statements are brought up to date monthly, and any inaccuracies that may be disclosed are corrected in the totals; the latest publication, therefore, is always the most reliable.
6. The above, with certain omissions, is the Report published by the Registrar-General of Statistics, S.S. and F.M.S., at Singapore on 23 November, 1935.

METEOROLOGICAL SUMMARY, MALAYA, OCTOBER, 1935.

Locality.	Air Temperature in degrees Fahrenheit							Earth Temperature		Rainfall								Bright Sunshine.		
	Means of			Absolute Extremes						Total.		Most in a day.	Number of days.					Total.	Daily Mean.	Per cent.
	A. Max.	B. Min.	Mean of A and B.	Highest Max.	Lowest Min.	Lowest Max.	Highest Min.	At 1 foot	At 4 feet			Amt.	Precipitation .01 in or more	Precipitation, .04 in or more	Thunder-storm	Fog morning obs.	Gale force 8 or more			
	°F	°F	°F	°F	°F	°F	°F	°F	°F	in.	mm.	in.						Hrs.	Hrs.	
Railway Hill, Kuala Lumpur, Selangor ...	89.7	72.4	81.1	94	70	83	75	84.1	84.8	11.38	289.1	4.13	23	19	3	1		159.60	5.15	43
Bukit Jeram, Selangor ...	88.2	72.7	80.5	93	71	82	75	83.8	86.4	7.36	186.9	2.10	20	17	1	1	1	176.10	5.68	47
Sitiawan, Perak ...	87.4	73.6	80.5	91	70	79	76	84.0	85.1	8.77	222.8	2.10	21	19	1			161.45	5.21	43
Temerloh, Pahang ...	88.9	72.6	80.7	92	70	83	75	84.7	86.5	10.38	263.7	2.87	17	14	3	1		161.20	5.20	43
Kuala Lipis, Pahang ...	87.5	71.5	79.5	91	70	83	73	83.1	84.5	21.74	552.2	2.97	27	22	1	22		159.85	5.16	43
Kuala Pahang, Pahang ...	86.9	74.1	80.5	90	72	80	76	85.7	86.9	11.25	285.8	4.43	18	17	1			173.95	5.61	46
Kallang Aerodrome, S'pore ...	86.0	76.3	81.1	89	74	80	80	83.0	84.4	4.06	103.1	1.33	13	12				159.15	5.13	42
Butterworth, Province Wellesley ...	86.3	73.8	80.1	90	72	79	76	84.5	85.3	22.80	579.1	4.42	28	22				156.10	5.03	42
Bayan Lepas Aerodrome, Penang ...	85.8	74.3	80.1	89	71	77	77	83.3	84.5	34.64	879.9	6.39	26	24	2			148.80	4.80	40
Bukit China, Malacca ...	84.6	73.6	79.1	88	72	78	77	82.8	83.9	17.11	434.6	5.15	18	18			2	162.20	5.23	43
Kluang, Johore ...	87.8	71.2	79.5	91	69	77	73	81.3	82.0	9.99	253.7	2.59	18	18	4	9		123.30	3.98	33
Bukit Lalang, Mersing, Johore	85.8	72.2	79.0	90	71	79	74	81.5	81.7	10.69	271.5	2.84	21	14	1	1		141.90	4.58	38
Alor Star, Kedah ...	86.9	73.9	80.4	90	71	80	76	85.9	86.4	10.36	263.1	1.92	26	23	7	1		175.40	5.66	47
Kota Bahru, Kelantan ...	87.5	73.6	80.5	91	71	80	76	84.0	85.4	9.86	250.4	1.88	18	17	2	1		181.65	5.86	49
Kuala Trengganu, Trengganu	87.4	72.9	80.1	91	72	80	75	83.4	85.3	6.30	160.0	3.15	16	14	2	1		188.45	6.08	51
HILL STATIONS.																				
Fraser's Hill, Pahang 4268 ft.	73.9	62.5	68.2	77	60	68	64	72.1	72.6	10.56	268.2	2.79	23	23	2	15	1	133.85	4.32	36
Cameron Highlands, Tanah Rata, Pahang 4750 ft. ...	71.4	59.5	65.5	76	56	63	63	70.0	69.9	14.92	379.0	1.71	26	25			2	80.70	2.60	22
Cameron Highlands, Rhododendron Hill, Pahang 5120 ft. ...	70.3	59.7	65.0	74	58	63	61			15.98	405.9	1.98	27	25			2	79.80	2.57	21

Compiled from Returns supplied by the Meteorological Branch, Malaya